(19)日本国特許庁（ＪＰ）　(12) 特許公報（Ｂ２）　(11)特許番号

第2628886号

(45)発行日　平成9年（1997）7月9日　(24)登録日　平成9年（1997）4月18日

(51)Int.Cl.⁶	識別記号	庁内整理番号	Ｆ Ｉ	技術表示箇所
Ｃ２５Ｄ　5/08			Ｃ２５Ｄ　5/08	
5/20			5/20	
21/04			21/04	

請求項の数２　（全 5 頁）

(21)出願番号　特願昭63－124210

(22)出願日　昭和63年（1988）5月19日

(65)公開番号　特開平1－294888

(43)公開日　平成1年（1989）11月28日

前置審査

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(56)参考文献　特開　昭５８－４５３９５（ＪＰ，Ａ）
特開　昭５６－８４４９８（ＪＰ，Ａ）

(54)【発明の名称】電解メッキ装置

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(57)【特許請求の範囲】

【請求項１】ポンプによるメッキ液の循環機能を有し、メッキ槽内に設けられ、その上部開口から常にオーバフローし循環するメッキ液を収容するカップ部と、このカップ部に設けられ、基板と接触するカソードコンタクト部と、このカソードコンタクト部に電流を流し前記基板表面にメッキ金属層を形成する電源手段とを備えた電解メッキ装置において、前記基板を前記メッキ液中で基板表面を上向きにして設置し、噴出具合を調整する流速変調機構を設置し、かつ前記カソードコンタクト部と基板との接触部へのメッキ液の侵入を防止するための封止部材を備えた基板ホルダ部と、前記カップ部内のメッキ液中に設置された超音波振動子とを有し、前記カップ部にこのカップ部内の空気を吸収し減圧する通気孔を備えたことを特徴とする電解メッキ装置。

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【請求項２】ポンプによるメッキ液の循環機能を有し、メッキ槽内に設けられ、その上部開口から常にオーバフローし循環するメッキ液を収容するカップ部と、このカップ部に設けられ、基板と接触するカソードコンタクト部と、このカソードコンタクト部に電流を流し前記基板表面にメッキ金属層を形成する電源手段とを備えた電解メッキ装置において、前記カップ部内に、基板ステージを設け、この基板ステージ上に前記基板を基板表面を上向きにして設置し、前記メッキ液を前記基板の上方より前記カップ部内に噴出せしめるメッキ液導入口を前記カップ部の上部に設け、更に噴出具合を調整する流速変調機構を設置し、かつ封止部材によって前記カソードコンタクト部と基板との接続部へのメッキ液の侵入を防止するようにしたことを特徴とする電解メッキ装置。

【発明の詳細な説明】

〔産業上の利用分野〕

この発明は、基板の主面に金属層を形成する電解メッキ装置に関するものである。

〔従来の技術〕

第４図は従来の電解メッキ装置におけるカップ部を示す断面図で、１はカップ部で、図示はしてないがメッキ槽内に設置されている。

1aはメッキ液噴流口、1bは前記カップ部１からメッキ液が流出するメッキ液オーバフロー用穴、２は基板、2aは金属層が形成される基板表面、３は基板押えばね、４は電源、５はアノード、６は前記基板２と接触するカソードコンタクト部、７は前記カップ部１とメッキ槽内を循環するメッキ液、８は前記メッキ液７の流れを示す矢印、９は前記メッキ液７内に発生する気泡、10はメッキ液循環用ポンプ、11はメッキ液タンクをそれぞれ示す。

また、第５図は従来装置の問題点の１つを説明するための基板２の部分断面図で、12はメッキ金属層、12aはこのメッキ金属層12の突起で、その他の符号は第４図と同一部分を示している。なお、第４図と上下は逆にして示してある。

次に、機能および動作について説明する。

基板２は、基板表面2aを下向きにし、カップ部１に固定されたカソードコンタクト部６の先端に接触して設置され、上から基板押えばね３で押えることによって同時に電源４の負極側と基板表面2aとの電気的コンタクトを得る。また、メッキ液噴流口1aはメッキ液循環用ポンプ10に接続され、メッキ液７はその流れを矢印８で示すように、メッキ液噴流口1aから噴出し、基板表面2aと接しつつ、カップ部１のメッキ液オーバフロー用穴1bからオバーフローし、メッキ液タンク11に回収され、再びメッキ液循環用ポンプ10によってカップ部１に送られる。アノード５は、カップ部１内に基板２に平行になるように設置され、カップ部１にメッキ液７を流しながらアノード５と基板２、つまりカソード間に電流を印加することによってメッキ液７の電解反応がおこり基板表面2aにメッキ金属が析出する。

〔発明が解決しようとする課題〕

上記のように構成された従来の電解メッキ装置では、メッキ金属の被析面である基板表面2aが下向きに設置されているため、メッキ液７の循環系やカソード反応で発生するガスが気泡９として基板表面2aに抱き込まれて留まり易く、この気泡９はメッキ液７中のカチオンの移送を阻害し、ひいてはメッキ成長を阻害するため、メッキの欠陥が生じることは不可避であった。

また、針状のカソードコンタクト部６と基板２の接触点付近では第５図に示すように、メッキ金属層12の突起12aが生じるなどの問題点があった。

この発明は、上記のような問題点を解決するためになされたもので、基板表面への気泡の抱き込みによるメッキ欠陥を防止した電解メッキ装置を得ることを目的とするものである。

〔課題を解決するための手段〕

この発明に係る請求項（１）に記載の電解メッキ装置は、基板をメッキ液中で基板表面を上向きにして設置し、更に噴出具合を調整する流速変調機構を設置し、かつカソードコンタクト部と基板と接触部へのメッキ液の浸入を防止するための封止部材を備えた基板ホルダ部と、カップ部内のメッキ液中に設置された超音波振動子とを有し、カップ部にこのカップ部内の空気を吸引し減圧する通気孔を備えたものである。

また、この発明に係る請求項（２）に記載の電解メッキ装置は、カップ部内に、基板ステージを設け、この基板ステージ上に前記基板を基板表面を上向きにして設置し、前記メッキ液を前記基板の上方よりカップ部内に噴出せしめるメッキ液導入口を前記カップ部の上部に設け、更に噴出具合を調整する流速変調機構を設置し、かつ封止部材によって前記カソードコンタクト部と基板との接続部へのメッキ液の侵入を防止するようにしたものである。

〔作用〕

この発明の請求項（１）に記載の発明においては、基板表面を上向きに設置したことから、気泡が基板表面に留まりにくくなり、また、超音波振動子をメッキ液中に備えたことにより、消泡・破泡作用が付加され、また、カップ部内のメッキ液面上の空気の吸引減圧により、前記気泡がメッキ液中から吸引除去される。さらに、カソードコンタクト部へのメッキ液の浸入を防止したことにより、カソードコンタクト部へはメッキ金属の成長が行われない。

また、この発明の請求項（２）に記載の発明においては、基板の上方よりメッキ液を噴流させることによって、メッキ液流により気泡が基板表面に留まることなく除去される。

〔実施例〕

以下、この発明の一実施例を図面について説明する。

第１図はこの発明の一実施例を示す構成図で、第４図と同一符号は同じものを示し、21はカップ部であり、21aはメッキ液噴流口、21bはメッキ液オーバフロー用穴、21cは前記カップ部21に設けられた通気孔、21dは前記カップ部21を上、下に取り外しできるカップ接合部、22は前記基板２を保持する基板ホルダ部、22aは前記基板２を上向きに基板ホルダ部22に固定するための基板固定部、22bは前記メッキ液７が基板２とカソードコンタクト部６との接触部に浸入しないように封止する封止部材、23は前記カップ部21内に設置された超音波振動子、24は前記カップ部21内の空気、25は前記カップ部21内の空気24を通気孔21cから排出し、カップ部21内を減圧する減圧方向を表す矢印である。

上記のように構成された電解メッキ装置において、カップ部21はカップ接合部21dより上部が取り外し可能と

なっており、基板2をカップ部21内にセットする時、まずカップ接合部21dより上部を取り外し、基板2を基板ホルダ部22の上に置き基板固定部22aにより位置の固定を行う。基板固定部22aにはカソードコンタクト部6が付属しており、基板2の固定と同時にカソードのコンタクトが行える。さらに、基板固定部22aに併設された封止部材22bにより、カソードコンタクト部6へのメッキ液7の浸入は防止される。

メッキ液7の循環方法は、従来装置と同様で、メッキ液7はメッキ液噴流口21aからカップ部21内に導入され、メッキ液オーバフロー用穴21bから導出される。また、電流の印加方法も従来装置におけるものと同様であるが、基板表面2aを上向きに設置したため、基板2、つまりカソードに対向するアノード5はカップ部21内において基板2より上側に位置している。アノード5より上側のメッキ液7中には超音波振動子23が設置され、また、カップ部21内のメッキ液7面より上部の空気24は通気孔21cに連続された真空ポンプ等（図示せず）の減圧機能により吸引減圧される。

第2図はこの発明の他の実施例を示す構成図である。この図において、第1図と同一符号は同じものを示し、31はカップ部、31aは前記カップ部31の上方に設けられたメッキ液導入口で、メッキ液7を基板表面2aの上方より噴出せしめる。31bは前記カップ部31からのメッキ液7をメッキ槽（図示せず）へ流出せしめるメッキ液流出口である。32は基板ステージで、基板2が基板表面2aを上向きにして設置される。33は前記基板ステージ32を押し上げ、基板ステージ32の脱着の際用いる基板ステージ押し上げ台である。

次に、動作について説明する。

上記のように構成された電解メッキ装置において、カップ部31内の基板2は、基板表面2aを上向きにし、基板ステージ32上に設置される。基板2は、基板押さえばね3によって適度に弾性を得た単数または複数本のピン状のカソードコンタクト部6によって押さえられ、同時に電源4の負極側と基板表面2aとの電気的コンタクトを得る。また、メッキ液導入口31aはカップ部31の上部に設けられているため、従来法と同様にメッキ液循環用ポンプ10から供給されたメッキ液7はアノード5と基板2間を流れ、カップ部31のメッキ液流出口31bからオバーフローし、メッキ液タンク11に回収され、再びメッキ液循環用ポンプ10によってカップ部31に送られる。電流印加の機能は従来装置と同様である。このように、カップ部31の上方よりメッキ液7は基板表面2a上を流れるように供給されるので、気泡9が基板表面2aに留まることなく、良品質のメッキ金属層が得られる。

なお、この実施例では、基板2の脱着用に、基板ステージ押し上げ台33を設けたものを示したが、この基板ステージ押し上げ台33は必らずしも必要ではない。また、実際にはカップ部31の下部にメッキ液7を抜き取る小孔等を要するが、第2図では省略してある。

さらに、上記実施例において、液流リミッタ，エアーオペレーションバルブ等と、制御回路とを組み合せたものを付加し、メッキ液循環用ポンプ10によって送られるメッキ液7の流れ（矢印8）に対し変調をかける機能を設ければ、メッキ液7の流れを適宜に制御することができ、さらに、効果は大となる。

次に、この発明のさらに他の実施例を第3図について説明する。第3図において、41はこの発明のカップ部、41aは前記カップ部41の上方よりメッキ液7が供給されるように設けたメッキ液導入口、41bはメッキ液流出口、42は前記カップ部41の上部に設けたスプレーノズルで、このスプレーノズル42よりメッキ液7をカップ部41の上部のメッキ液導入口41aよりメッキ液7をカップ部41内に噴出する。その他の符号は第1図と同一または相当部分を示している。

メッキ液7の循環方法，電流印加方法は第1図に示した実施例のものと同様であるが、第3図の実施例では、カップ部41の上部に複数個のスプレーノズル42を基板表面2aに対し平行な面内に配し、基板表面2a上いたる所で均一なメッキ液7の流速が得られるようにしている。

上記のように、カップ部41の上方よりメッキ液7を導入するとともに、メッキ液7の流速に変調を加えたり、メッキ液流を基板2に向けて均一噴射したりすることにより、基板表面2a上に気泡9の滞留を防止する効果がさらに増大するばかりでなく、メッキ液7の液流が均一化され、均一な膜厚のメッキ金属層が得られる。

なお、第3図の実施例においては、スプレーノズル42の先端部自体がアノード5となる場合について示したが、これは分離されて配置されたものでもよい。

〔発明の効果〕

以上説明したように、この発明の請求項（1）に記載の発明は、基板をメッキ液中で基板表面を上向きにして設置し、更に、噴出具合を調整する流速変調機構を設置し、かつカソードコンタクト部と基板との接触部へのメッキ液の浸入を防止するための封止部材を備えた基板ホルダ部と、カップ部内のメッキ液中に設置された超音波振動子とを有し、前記カップ部にこのカップ部内の空気を吸引し減圧する通気孔を備えたので、メッキ中発生するガスが気泡として基板に留まりにくくなり、前記気泡によるメッキ欠陥を防止できる効果がある。また、カソードコンタクト部へのメッキ液の浸入を防止したことにより、従来のように、カソードコンタクト部へのメッキ成長は行われず、したがって、この部分へのメッキ突起の発生を防止できる効果がある。

また、この発明の請求項（2）に記載の発明は、カップ部内に、基板ステージを設け、この基板ステージ上に基板を基板表面を上向きにして設置し、メッキ液を前記基板の上方よりカップ部内に噴出せしめるメッキ液導入口を前記カップ部の上部に設け、更に噴出具合を調整す

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る流速変調機構を設置し、かつ封止部材によって前記カソードコンタクト部と基板との接続部へのメッキ液の侵入を防止するようにしたので、メッキ液は上方より基板表面上を流れるように供給されるため、気泡が基板表面に留まることなく除去することができ、気泡のだき込みによるメッキ欠陥を防止できる効果がある。

〔図面の簡単な説明〕

第１図はこの発明の一実施例による電解メッキ装置のカップ部を示す断面図、第２図はこの発明の他の実施例を示す電解メッキ装置の断面図、第３図はこの発明のさらに他の実施例を示す電解メッキ装置の断面図、第４図は従来の電解メッキ装置のカップ部を示す断面図、第５図は従来装置の問題点の一つを説明するための断面図である。

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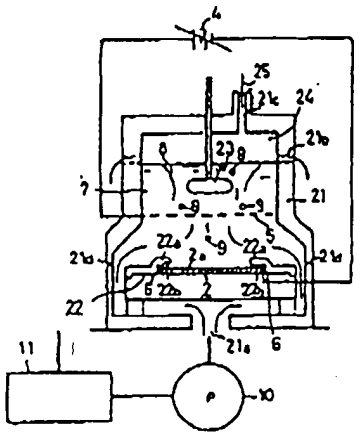
図において、２は基板、2aは基板表面、４は電源、５はアノード、６はカソードコンタクト部、７はメッキ液、８はメッキ液の流れ方向を示す矢印、９は気泡、10はメッキ液循環用ポンプ、11はメッキ液タンク、21,31はカップ部、21aはメッキ液噴流口、21bはメッキ液オーバーフロー用穴、21cは通気孔、21dはカップ接合部、22は基板ホルダ部、22aは基板固定部、22bは封止部材、23は超音波振動子、24は空気、25は減圧方向を示す矢印、31aはメッキ液導入口、31bはメッキ液流出口、32は基板ステージ、33は基板ステージ押し上げ台、である。

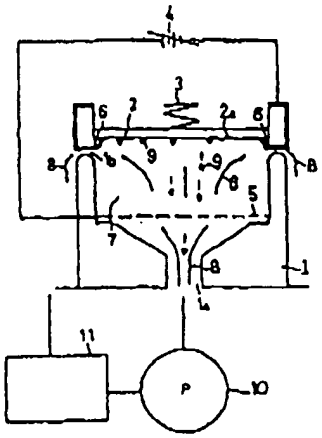
なお、各図中の同一符号は同一または相当部分を示す。

〔第１図〕

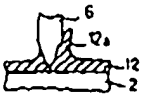


2 : 基板
2a : 基板表面
4 : 電源
5 : アノード
6 : カソードコンタクト部
7 : メッキ液
8 : メッキ液の流れ方向を示す矢印
9 : 気泡
10 : メッキ液循環用ポンプ
11 : メッキ液タンク
21 : カップ部
21a : メッキ液噴流口
21b : メッキ液オーバーフロー用穴
21c : 通気孔
21d : カップ接合部
22 : 基板ホルダ部
22a : 基板固定部
22b : 封止部材
23 : 超音波振動子
24 : 空気
25 : 減圧方向を示す矢印

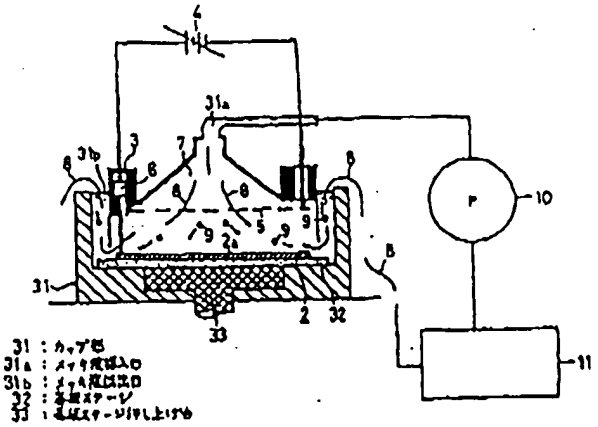
〔第４図〕



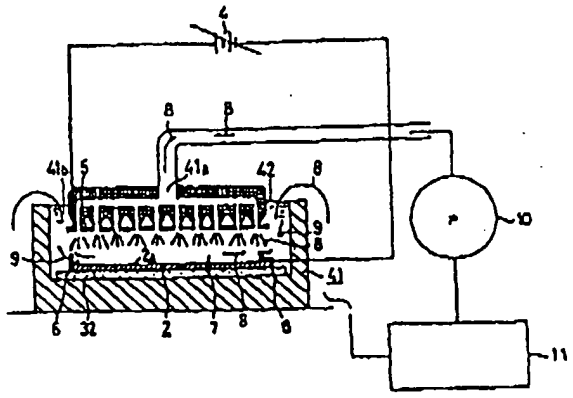
〔第５図〕



【第２図】


4
31a
3
7
31b
6
8
9
5
2a
31
33
2
32
P
10
11
31：カップ体
31a：メッキ液導入口
31b：メッキ液排出口
32：多孔ステージ
33：基板ステージ押し上げ棒

【第３図】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(19) JAPANESE PATENT OFFICE (JP)

(12) **Official Gazette for Patent Applications (B2)**

(11) Patent Number **No. 2628886**

(45) Date of Issue July 9, 1997

(24) Date of Registration April 18, 1997

(51) Int. Cl.[6]: Identification Symbol

C 25D 5/08
5/20
21/04

Internal Office Registration Numbers: F I Location for Displaying Technology

C 25D 5/08
5/20
21/04

Number of Inventions Claimed : 2

(Total of 5 pages)

(21) Application No. Patent Application Sho(wa) 63-124210

(22) Application Filing Date: May 19, 1988

(65) Disclosure Number: Patent Disclosure Hei(sei) 1-294888

(43) Disclosure Date: November 28, 1989

Initial Examination

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(56) Reference Documents: Patent Disclosure Sho(wa) 58-45395 (J P, A)
Patent Disclosure Sho(wa) 56-84498 (J P, A)

(54) [Title of Invention] Electrolytic Plating System

(57) **[Patent Claim Scope]**

[Claim Item 1]

A system for electrolytic plating, said system comprising: a pump for circulating the plating fluid, a cup which is installed in the plating vessel with said cup having upper openings to accommodate the circulating plating fluid and any overflow; Within said cup, electric current flows to the cathode contact part and the contacting area between the cathode contact part and the base board, making up the electrolytic plating method for forming a plating metal layer on the aforementioned base board. Said system is installed with the aforementioned base board in the aforementioned plating fluid with the base board surface facing in the upward direction; moreover, said system is installed with a current modulating mechanism for adjusting the ejection conditions and is installed with a base board holder equipped with a sealing member that prevents plating fluid seepage into the connection area between the aforementioned cathode contact part and the base board; said system is also characterized by having an ultrasonic oscillator installed in the plating fluid of the aforementioned cup, with said cup providing pressure reducing ventilation holes for suctioning out the air in said cup.

[Claim Item 2]

A system for electrolytic plating, said system comprising: a pump for circulating the plating fluid, a cup which is installed in the plating vessel with said cup having upper openings to accommodate the circulating plating fluid and any overflow; Within said cup, electric current flows to the cathode contact part and the contacting area between the cathode contact part and the base board, making up the electrolytic plating method for forming a plating metal layer on the aforementioned base board. Said system is installed with a base board stage inside the aforementioned cup; the aforementioned base board is installed on top of said base board stage with the base board surface facing in the upward direction; the aforementioned plating fluid is ejected - from above - through a plating fluid inlet provided in the upper part of the aforementioned cup, onto the aforementioned base board; said system is also installed with a current modulating mechanism for adjusting the ejection flow; moreover, the system is characterized by the capability to prevent plating fluid seepage into the connection area between the aforementioned cathode contact part and the base board by means of a sealing member.

[Detail Description of Invention]

[Sphere of Industrial Utilization]

The present invention relates to an electrolytic plating system for forming a metal layer on the principal plane of base boards.

[Conventional Technology]

Fig. 4 is a cross sectional drawing of the cup part of a typical conventional electrolytic plating system. (1) is the cup. Although not indicated in the illustration, it is installed within the plating vessel.
(1a) is the plating fluid ejection nozzle; (1b) is the hole used for overflow of the plating fluid flowing from the above mentioned cup. (2) is the base board; (2a) is the base board surface formed by the metal layer. (3) is the base board pressure bar spring. (4) is the electrical power source. (5) is the anode. (6) is the cathode contact part which is in contact with the above mentioned base board (2). (7) is the circulating plating fluid inside the above mentioned cup (1) and plating vessel. (8) indicates the flow of the above mentioned plating fluid (7). (9) are the bubbles developed within the above mentioned plating fluid (7). (10) is the pump used for circulating the plating fluid. (11) is representative of the plating fluid tank.

Fig. 5 is a partial cross sectional drawing of a base board (2) which is provided to demonstrate one of the problems encountered in a typical conventional system. (12) is the plating metal layer; (12a) is a protrusion on the said plating metal layer (12). The remaining symbols in Fig. 5 indicate the same parts as in Fig. 4, except that the vertical direction is opposite of Fig. 4.

The following describes the functionality and operation.

The base board (2) is installed such that the base board surface (2a) is facing downward and is in contact with the end of the cathode contact part (6) which is fixed in position in the cup (1). As the base board pressure bar spring (3) is pressed from above, electrical connection between the base board surface (2a) and the negative pole of the electrical power source (4) is achieved. The plating fluid ejection nozzle (1a) is linked by the plating fluid circulating pump (10), and the plating fluid (7) begins to flow in the direction as indicated by symbol (8). As the plating fluid is ejected from the ejection nozzle (1a), contact is made with the base board surface (2a); it overflows from the plating fluid overflow hole (1b) of the cup (1), and is recovered back to the plating fluid tank (11); then once again is sent to the cup (1) by means of the plating fluid circulating pump (10). The anode (6) is installed within the cup (1), such that it is parallel to the base board (2). As the plating fluid (7) circulates through the cup (1), electric current is applied to the anode (5) and base board (2), in other words, between the cathodes, causing an electrolytic reaction to occur within the plating fluid, resulting in the deposit of plating metal onto the base board surface (2a).

[Problematic Issues Which the Present Invention Attempts to Solve]

In the case of a typical conventional electrolytic plating system constructed in the above described manner, because the base board surface (2a) - the surface covered by the plating metal - is installed facing downwards, gas bubbles (9), developed due to e.g. circulation of the plating fluid or cathode reactions, tend to collect and deposit onto the base board surface (2a). Since these gas bubbles (9) obstruct the transmission of cations in the plating fluid, and in turn, obstruct the plating growth process, occurrences of plating defects become inevitable.

Furthermore, many other problems could occur near the contact area between the base board (2) and the needle-shaped cathode contact part (6), such as development of protrusions (12a) on the plating metal layer, as illustrated in Fig. 5.

Said invention is developed with the goal of solving the above mentioned types of problems, and of establishing an electrolytic plating system that prevents plating defects due to collected deposit of gas bubbles on base board surfaces.

[Methods Used to Solve the Above Mentioned Problematic Issues]

The electrolytic plating system mentioned in Claim (1) of said invention, installs the base board in the plating fluid, with the base board surface facing upwards. In addition, it is installed with a current modulating mechanism that adjusts accordingly to the ejection condition. Moreover, said invention comprises of a base board holder which provides a sealing member that prevents seepage of plating fluid into the contact area between the base board and the cathode contact part. Said invention also comprises of an ultrasonic oscillator which is installed in the plating fluid within the cup. Said invention also provides pressure releasing air holes on the cup for suctioning air from the cup.

Furthermore, the electrolytic plating system mentioned in Claim (2) of said invention, provides a base board stage within the cup. Said invention is installed with the aforementioned base board on top of said base board stage, with the base board surface facing upwards. This invention provides a plating fluid inlet at the upper portion of the aforementioned cup for the purpose of ejecting the aforementioned plating fluid onto the top of the aforementioned base board. Additionally, it is installed with a current modulating mechanism that adjusts according to the ejection condition. Moreover, said invention is designed to prevent any plating fluid seepage into the connection areas between the base board and the aforementioned cathode contact part, by means of a sealing member.

[Functions]

As to the invention as recorded in Claim (1) of said invention, since the base board is installed with the base board surface facing in the upward direction, it becomes very difficult for gas bubbles to collect and remain on the base board surface. Also, said invention provides an ultrasonic oscillator, placed in the plating fluid, which enhances the de-foaming and foam breaking functionality. Furthermore, since any air above the plating fluid surface within the cup is sucked under reduced pressure, the aforementioned gas bubbles can be aspirated and eliminated from the plating fluid. Additionally, because plating fluid seepage into the cathode contact part can be prevented, it is no longer possible for the plating metal to grow toward the cathode contact part.

As to the invention as recorded in Claim (2) of said invention, since the plating fluid is ejected and jetted onto the top surface of the base board, gas bubbles within the plating fluid flow no longer deposit on the base board surface, thus are eliminated.

[Implementation Examples]

Following is a description about the attached drawing, showing one implementation example of said invention. Fig. 1 is a block diagram illustrating one implementation example of said invention.

Numbers in Fig. 1 which are also in Fig. 4, represent the same things. Other numbers are described as follows: (21) is the cup; (21a) is the plating fluid ejection nozzle; (21b) is the plating fluid overflow hole; (21c) is the air hole provided in aforementioned cup (21); (21d) is the vertically removable cup connection part in the aforementioned cup (21). (22) is the base board holder that holds the aforementioned base board; (22a) is the base board anchoring part used for fixing the aforementioned base board (2) upwards against the base board holder (22); (22b) is the sealing member used for preventing seepage of aforementioned plating fluid (7) into the contacting area between the base board (2) and the cathode contact part. (23) is the ultrasonic oscillator provided inside aforementioned cup (21). (24) is the air inside aforementioned cup (21). (25) is the symbol representing the pressure reducing direction in the cup (21) when the air (24) inside the aforementioned cup (21) is discharged from the air hole (21c).

In an electrolytic plating system assembled as above, the cup (21) is above the cup connection part (21d), but is removable. When setting the base board (2) inside the cup (21), the top portion is first removed from the cup connection part (21d), then the base board (2) can be fixed in place to the base board holder (22), by using the base board anchoring part (22a) above. Since the cathode contact part (6) is attached to the base board anchoring part (22a), as the base board (2) is fixed in place, contact to the cathode is also established. Since the sealing member (22b) is also provided in the baseboard anchoring part (22a), any seepage of plating fluid (7) into the cathode contact part (6) is prevented.

The plating fluid (7) circulation method is similar to typical conventional systems. Plating fluid (7) is introduced into the cup (21) from the plating fluid ejection nozzle (21a); any overflow is led out via the plating fluid overflow hole (21b). The method for applying electric current is also similar to the typical conventional systems. However, since the base board surface (2a) is installed facing upwards, the anode (5), opposite to the cathode, is positioned on the top side of the base board (2) inside the cup (21). The ultrasonic oscillator (23) is installed in the plating fluid (7), above the anode (5). Furthermore, air (24) above the plating fluid (7) surface inside the cup (21) is low-pressure extracted via pressure reducing capabilities of e.g. a vacuum pump (not illustrated in fig.) that could be connected to the air hole (21c).

Fig. 2 is the block diagram illustrating another implementation example of said invention. Numbers in Fig. 2 which are also used in Fig. 1, represent the same things. In Fig. 2, (31) is the cup; (31a) is the plating fluid inlet nozzle provided on the upper part of the aforementioned cup (31). The plating fluid (7) is ejected onto the base board surface (2a) from above. (31b) is the plating fluid outlet that enables the plating fluid (7) to flow out from the aforementioned cup (31) to the plating vessel (not illustrated in fig.). (32) is the base board stage, on top of which the base board (2) is installed - with the base board surface (2a) facing upwards. (33) is the platform used for thrusting up the aforementioned base board stage (32), or for the removal of the base board stage (32).

The following describes the operation.

In an electrolytic plating system assembled as above, the base board (2) inside the cup (31) is installed on top of the base board stage (32), with the base board surface (2a) facing upwards. The

base board (2), is pressed by the base board pressure bar spring (3), obtaining a suitable elasticity which is dependent on the odd or even number of pin shapes in the cathode contact part (6). As the base board is pressed, electrical contact between the base board surface (2a) and the negative pole end of the electric source (4) is established. Since the plating fluid inlet (31a) is designed and located in the upper part of the cup (31), the plating fluid (7), supplied via a conventional circulating pump (10), flows between the base board (2) and the anode (5). This plating fluid overflows from the cup's (31) plating fluid outlet (31b); it is recovered to the plating fluid tank (11), and then once again sent to the cup (31) by means of the plating fluid circulation pump (10).

Electric current is applied in the same way as in a typical conventional system. In this manner, the plating fluid (7) is supplied from top of the cup (31) to flow over the top of the base board surface (2a). As a result, gas bubbles (9) do not deposit on the base board surface (2a) and a plating metal layer of excellent quality is obtained.

Although this implementation example shows the provision of a base board stage thrusting platform (33) for the purpose of base board (2) removal, this base board stage thrusting platform (33) is not absolutely necessary. Also, realistically, other small pinholes for extracting plating fluid (7) from the lower part of the cup (31) would be necessary, but are omitted from Fig. 2.

In the above described implementation example, if a fluid current limiter or an air operation valve and such, are added and is an integral part of the control circuit, and if it is designed with means for modulating the plating fluid (7) flow (symbol 8) as it is sent via the plating fluid circulation pump (10), then proper control of the plating fluid's (7) flow can be achieved. This functionality would greatly enhance the system's effectiveness.

Following is a description of yet another implementation example of said invention. In Fig. 3, (41) is the cup of said invention; (41a) is the plating fluid inlet designed to provide plating fluid (7) from the top of aforementioned cup (41). (41b) is the plating fluid outlet. (42) is the spray nozzle provided in the upper part of aforementioned cup (41). Plating fluid (7) is ejected into the cup (41) via the said spray nozzle (42) and the plating fluid inlet (41a) located in the upper part of the cup (41). Other numbers in Fig. 3 are identical or similar to the numbers shown in Fig. 1.

The plating fluid circulation method and electric current application method are basically the same as in the implementation example shown in Fig. 1. However, for the implementation example of Fig. 3, in the upper part of the cup (41), an even number of spray nozzles (42) are placed and evenly distributed on an in-plane that is parallel to the base board surface (2a). This helps to attain a homogeneous plating fluid (7) current to every location on the base board surface (2a).

As described above, at the time that plating fluid (7) is led in from the top of the cup (41), modulation is applied to the plating fluid (7) flow speed to ensure a homogeneous jet stream of plating fluid in the direction of the base board (2). This not only greatly increases the effectiveness of preventing gas bubbles (9) from accumulating and depositing on the base board surface (2a), but also enables the homogeneity of flow of the plating fluid (7), resulting in a plating metal layer of uniform membrane thickness.

The implementation example shown in Fig. 3 illustrates the case where the point of each spray nozzle (42) is itself the anode. However, the system could also be designed where these are separate entities.

[Effect of the Invention]

As described above, the invention stated in Claim (1) of said invention, installs the base board in the plating fluid with the base board surface facing up. Said invention is also equipped with a current modulation mechanism for adjusting the ejection condition. It also comprises of a base board holder with a sealing member for prevention of plating fluid seepage into the contacting points between the base board and the cathode contact part, and an ultrasonic oscillator installed in the plating fluid within the cup. Because it is also equipped with pressure reducing air holes for suctioning out the air in the aforementioned cup, it makes difficult for gas and air bubbles - developed during plating process - to remain on the base board. As a result, this invention is very effective in the prevention of plating defects due to aforementioned gas bubbles. Additionally, because plating fluid seepage into the cathode contact part can be prevented, the prior problem of "plating growth" (protrusions) into the cathode contact part is no longer an issue. Therefore, this invention is also effective in the prevention of development of protrusions into the said area.

The invention, as stated in Claim (2) of said invention, is installed with a base board stage inside the cup. It is designed to have the base board fixed on top of the base board stage and to have the base board surface facing upwards. It is equipped with a plating fluid inlet in the upper part of the aforementioned cup, so that the plating fluid can be ejected from above onto the aforementioned base board. It is also equipped with a current modulating mechanism for adjustment of ejection conditions. Since a sealing member is used to prevent plating fluid seepage into the connection areas between the base board and aforementioned cathode contact part, and the plating fluid is supplied to flow onto the base board surface from above, gas bubbles no longer perch on top of the base board surface and are thus eliminated. As a result, it is effective in prevention of plating defects due to these deleterious gas bubbles.

[Brief Description of the Drawings]

Fig. 1 is the cross sectional drawing, showing the cup portion of an electrolytic plating system, of one implementation example of said invention. Fig. 2 is the cross sectional drawing of an electrolytic plating system illustrating another implementation example of said invention. Fig. 3 is the cross sectional drawing of an electrolytic plating system illustrating another more enhanced implementation example of said invention. Fig. 4 is a cross sectional drawing illustrating the cup portion of a conventional electrolytic plating system. Fig. 5 is a cross sectional drawing for demonstrating one of the may problems encountered in a conventional system.

As for the drawings: (2) is the base board; (2a) is the base board surface; (4) is the electric power source; (5) is the anode; (6) is the cathode contact part; (7) is the plating fluid; (8) is the symbol representing the flow direction of the plating fluid; (9) are gas bubbles; (10) is the pump for circulating the plating fluid; (11) is the plating fluid tank; (21) & (31) are the cups; (21a) is the

plating fluid ejection nozzle; (21b) is the hole for plating fluid overflow; (21c) is the air hole; (21d) is the cup connection; (22) is the base board holder; (22a) is the base board anchoring part; (22b) is the sealing member; (23) is the ultrasonic oscillator; (24) is air; (25) is the symbol indicating pressure reducing direction; (31a) is the plating fluid inlet; (31b) is the plating fluid outlet; (32) is the base board stage; (33) is the base board stage thrusting platform.

Parts in the various drawings having the same number indicate that they are identical or similar.

[Fig. 1]

(2) base board
(2a) base board surface
(4) electric power source
(5) anode
(6) cathode contact part
(7) plating fluid
(8) symbol representing the flow direction of the plating fluid
(9) gas bubbles
(10) pump for circulating the plating fluid
(11) plating fluid tank
(21) cup
(21a) plating fluid ejection nozzle
(21b) hole for plating fluid overflow
(21c) air hole
(21d) cup connection part
(22) base board holder
(22a) base board anchoring part
(22b) sealing member
(23) ultrasonic oscillator
(24) air
(25) symbol indicating pressure reducing direction

[Fig. 2]

(31) cup
(31a) plating fluid inlet
(31b) plating fluid outlet
(32) base board stage

(33) base board stage thrusting platform

[Fig. 3]

[Fig. 4]

[Fig. 5]